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ENVIRONMENT, PREGNANCY DURATION AND BODY MASS OF NEWBORNS

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Abstract

The relation was studied between the environment and the morphological conditions of 1796 newborns born in 1993-94. Two groups from areas of ecological risk and one from an ecologically "clean" area were investigated. Both the pregnancy duration and the body mass of the newborns proved to be decisively correlated with the state of the environment.

Key words: evironment, pregnancy duration, body mass of newborns, Gdynia, Kościerzy, Puck

Introduction

The recent progress in industrialization, urbanization and tourism in the province of Gdańsk has provoked a number of unfavourable changes in the atmosphere, the water resources, the soil and the flora together with a deterioration in the state of health of living organisms. The alarming conditions of the natural environment in Poland triggered an administrative step in March 1983 when 27 areas, currently inhabited by over one-third of the population of Poland, were declared to be at ecological risk (Tabs 1 and 2). Gdańsk province and some parts of the Elbląg region are such ecologically threatened areas, generally characterized by the following factors: 1) the loss of the natural balance in the environment, 2) a higher incidence of diseases due to environment degradation, 3) an increase in mortality in the population aged 40-59, and 4) high birthrate of newborns with low body mass (below 2500 g).

As indicated in numerous studies, the rate of morphological development and the state of health of the newborn population from an ecologically threatened area are considerably poorer as compared with the relevant values for populations from ecologically clean areas (ANDRYSZEK, 1993; ANDRYSZEK and DZIANKOWSKA, 1993; ANDRYSZEK et al., 1993; ROLEWICZ, 1993; SZUKALSKI, 1991; WÓJTOWICZ, 1996a,b,c). In view of the catastrophic condition of the natural environment in Poland, an attempt has been made to determine the factor that most decisively influences the pregnancy duration and the body mass in two populations of newborns in environmentally different

regions in Gdańsk province: the environmentally "clean" region of Kościerzyna, and the environmentally endangered regions of Puck and Gdynia.

Table 1. Regions of ecological risk

Area	Risk coefficient
1.Górnośląski	194291
2.Krakowski	33894
3.Szczeciński	8464
4.Łódzki	7767
5.Rybnicki	6930
6.Gdański	6634
7.Legnicko-głogowski	5972
8.Tarnobrzeski	4637
9.Bydgosko-toruński	3862
10.Wrocławski	3287
11.Opolski	2910
12.Poznański	2188
13.Koniński	1844
14.Tarnowski	1275
15.Częstochowski	1274
16.Turoszowski	1204
17.Wałbrzyski	763
18.Białe Zagłębie	705
19.Inowrocławski	610
20.Płocki	599
21.Puławski	318
22.Chełmski	312
23.Włocławski	289
24.Bełchatowski	247
25.Myszkowsko-zawierciański	192
26.Jeleniogórski	185
27.Tomaszowski	171

Table 2. Gdańsk ecological risk region

ELBLĄG PROVINCE	
City	Community
Braniewo, Elbląg, Frombork, Tolkmicko	Braniewo, Elbląg, Frombork, Milejewo, Stegna, Sztutowo, Tolkmicko,
GDAŃSK PROVINCE	
City	Community
Gdańsk, Gdynia, Hel, Jastarnia, Pruszcz Gdański, Puck, Reda, Rumia, Sopot, Wejherowo, Władysławowo	Cedry Wielkie, Kolbudy Górne, Kosakowo, Krokowa, Pruszcz Gdański, Puck, Wejherowo, Żukowo

Materials and method

A group of 1796 newborns was investigated as concerns body mass and the duration of pregnancy. The revelant data came from questionnaires circulated in the years 1993-94 in Gdańsk province hospitals (Gdynia, Puck and Kościerzyna). The means and the standard deviations were calculated; the statistical

significance of differences was verified with the test of two means (GREŃ, 1972). The data on the state of the environment were obtained from the Office of Statistics in Gdańsk and from the Polish National Office of Statistics. The material in the paper comprises only part of our data on 6000 newborns from all hospitals in Gdańsk province, which will be analysed progressively.

Results and discussion

The condition of the environment is commonly seen to be a vital factor as concerns the economies of invidual countries worldwide, Poland included, and studies on the population of newborns, whose state of health is undoubtadely linked with environmental hazards, are important and well-founded.

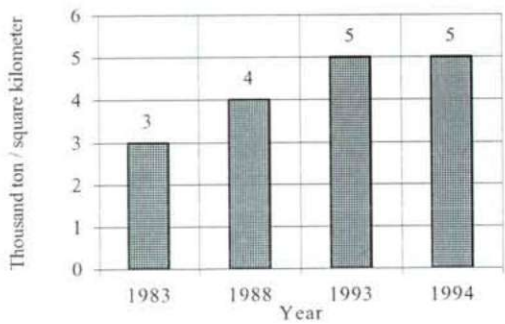

Fig. 1. Industrial pollution in Gdańsk province in 1983-94.

Genetic material undergoes modifications triggered by environmental factors; the directions such changes take depend on the condition of the environment.

Analysis of the data obtained from the Gdańsk Office of Statistics and the Polish National Office of Statistics and of our data on 1796 newborns (the duration of pregnancy and body mass) revealed the following about the environmental hazards in the region:

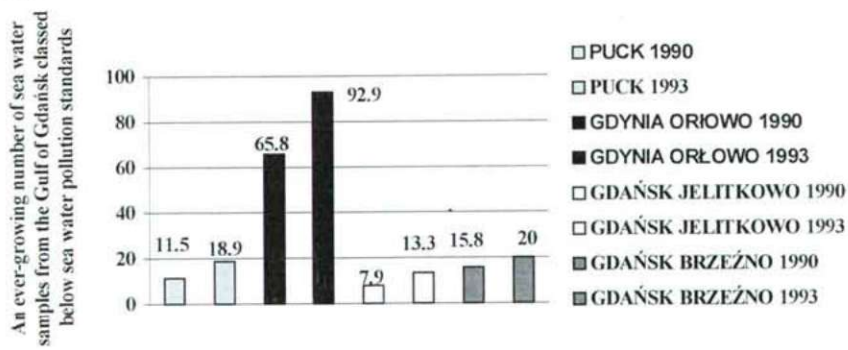

Fig. 2. Number of seawater samples from the Gulf of Gdańsk classified as below seawater pollution standard.

1. An increase in the industrial pollution of the local environment in the years 1983-94 (Fig.1).

2. An ever-growing number of seawater samples from the Gulf of Gdańsk classified as being below seawater pollution standards (Fig. 2).

3. A persistently high consumption of underground water resources in the region (60% locally vs. 15% countrywide), particularly by industry.

4. An insufficient number of sewage plants in the region (Fig. 3).

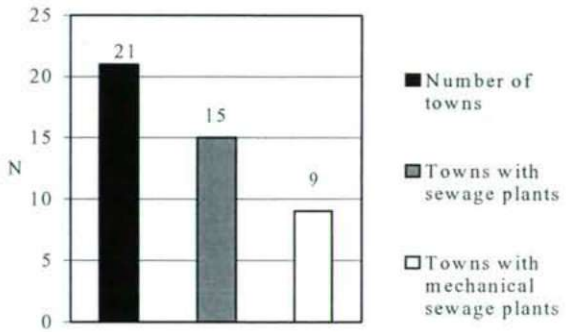

Fig. 3. Sewage plants in Gdańsk province in 1993.

5. An increase in carbon monoxide emission in the region (Fig. 4).

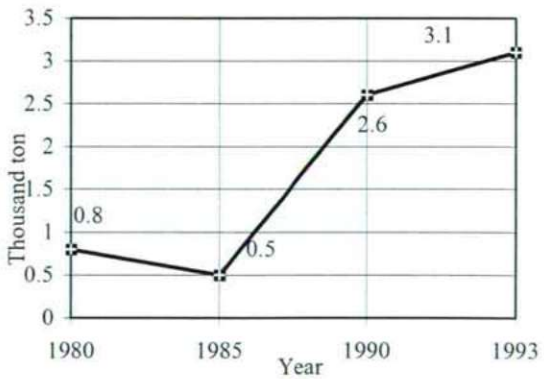

Fig. 4. Carbon monoxide emission in Gdańsk province in 1980-93.

6. Insufficient neutralization (below 1%) of gaseous pollutants comprising sulphur dioxide, nitrogen oxides and carbon monoxide (Fig. 5).

7. An alarmingly high and persistent level of carbon monoxide in the air (Fig. 4).

Carbon monoxide is a cigarette smoke component and one of the many agents responsible for the decreased oxygen level in the cells of the mother and the fetus cells. The decreased oxygen level in cells leads to an increase in the fetal carboxyhemoglobin

level, which in turn reduces the potential of the blood both to carry oxygen around the body and to transfer it to the fetal tissues. Additionally, carbon monoxide reacts with cytochrome oxidase to aggrevate the intracellular oxygen deficiency and to affect adversely the biological condition of the fetus (BIENKIEWICZ, 1986; KOWALSKI, 1994; KUBICKI, 1991; Statistical Annals of Gdańsk province 1984, 1989, 1994; Sattistical reports - environment protection in Gdańsk province, 1994).

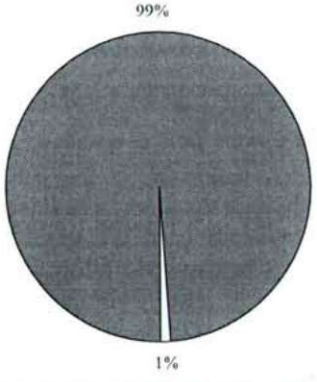

Fig. 5. Neutralization of gaseous pollution in Gdańsk province in 1993. 1%-Neutralization (below 1%) of gaseous pollutants comprising sulfur dioxide, nitric oxides and carbon monoxide.

8. In ecologically clean areas, the duration of pregnancy does not differ significantly between newborns of non-smoking parents and newborns of parents who smoke. However, it is statistically significant in environmentally endangered areas (d=0.001), and appears to be longer by nine-tenths of a week for the newborns of non-smoking parents (Fig. 9).

Fig. 6. Newborns with body mass below 2500 g in 1993-94.

9. In the areas of ecological risk (Gdynia and Puck), there are more newborns of low body mass (below 2500 g) than in ecologically "clean" areas; for the regions of Gdynia and Puck, this difference is about 1% and 3%, respectively (Fig. 6).

10. The most significant differences in pregnancy duration and body mass are manifested in springtime (21.03-21.06). Babies born in ecologically "clean" areas then have a body mass higher by approximately 187 g, which is a statistically significant difference at the level of d=0.01. Additionally, newborns from ecologically endangered areas are delivered about half a week earlier (d=0.02) than the normal term in ecologically healthy areas (Figs 7 and 8).

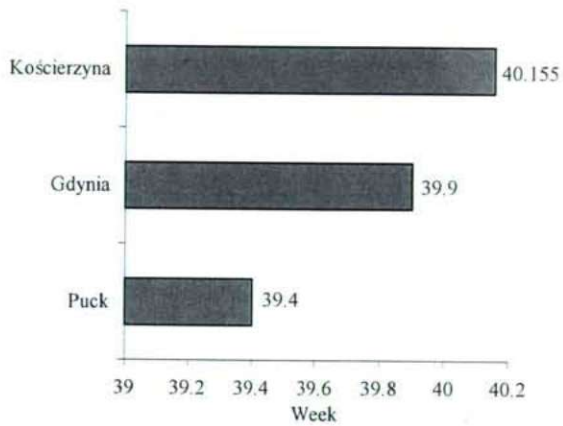

Fig. 7. Duration of pregnancy in springtime in 1993-94.

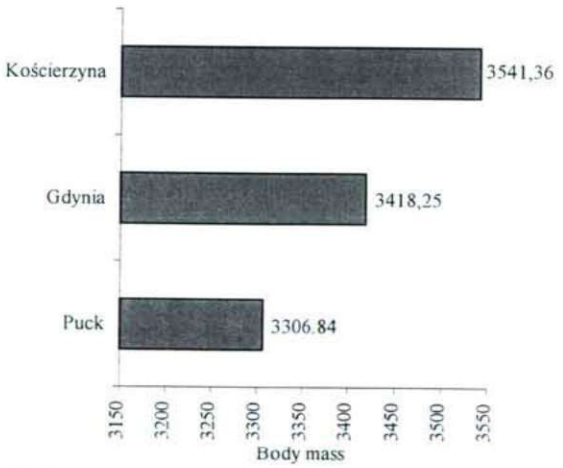

Fig. 8. Body mass of newborns born in springtime in 1993-94.

11. In springtime, the duration of pregnancy and the body mass of babies born to smoking parents in ecologically endangered areas generally appear below the norm.

The above results underline the fact that studies on the morphological condition of newborns as a function of the state of the environment are vital, and should model modern strategies towards our environment.

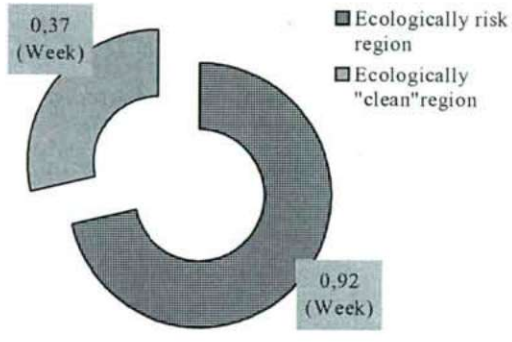

Fig. 9. Difference in duration of pregnancy between newborns of non-smoking parents and newborns of parents who smoke in 1993-94.

Conclusions

1796 newborns born in the years 1993-94 in three Gdańsk province hospitals (Gdynia, Puck and Kościerzyna) were investigated. The data on the state of the environment were obtained from the Office of Statistics in Gdańsk and from the Polish National Office of Statistics. The results show 1) an increase in the environment degradation, 2) in the areas of ecological risk (Gdynia and Puck), there were more newborns of low body mass (below 2500g) than in the ecologically clean area, and 3) the most significant differences in pregnancy duration and body mass are manifested in springtime.

References

ANDRYSZEK, CZ. (1993): Comprehensive evaluation of population health in provinces comprising high ecological risk areas as compared with so-called "ecologically clean" provinces. - Zdrowie Publ. *104*, 101-106, (in Polish).

ANDRYSZEK, CZ. and DZIANKOWSKA, E. (1993): Comprehensive assessment of the demographic situation of the population living in provinces of ecological danger as compare with "ecologically clean" provinces. - Zdrowie Publ. *104*, 193-196 (in Polish).

ANDRYSZEK, CZ., KOŃCZALIK, J., DUTKIEWICZ, T. and RACHAŃSKI, D. (1993): Premature mortality in areas of ecological risk (AER) in comparison with that in ecologically clean areas. - Zdrowie Publ. *105*, 57-67 (in Polish).

BIEŃKIEWICZ, L. (1986): Parental smoking and the state of health of the newborn. - Przegl. Pediatr. *16*, 1 (in Polish).

GREŃ, J. (1972): Models and tasks in mathematical statistics. - Warsaw (in Polish).

KOWALSKI, I. M. (1994): Influence of smoking on fetus birth weight and development of the newborn. - Zdrowie Publ. *105*, 89-90 (in Polish).

KUBICKI, J. (1991): Effect of smoking on fetal condition. - Gin. Pol. *62*, 489-491 (in Polish).

ROLEWICZ, CZ. (1993): Changes to the natural environment in the ecological risk areas in the years 1982-1988-1990. - Warsaw (in Polish).

Statistical Annal of Gdańsk province (1984). - Gdańsk Office of Statistics (in Polish).

Statistical Annal of Gdańsk province (1989). - Gdańsk Office of Statistics (in Polish).

Statistical Annal of Gdańsk province (1994). - Gdańsk Office of Statistics (in Polish).

Statistical reports - environment protection in Gdańsk province (1994). - Gdańsk Office of Statistics (in Polish).

SZUKALSKI, J.(1991): Changes to natural environment of Gdańsk due to man. - Jantarowe Szlaki *1*, 7-12 (in Polish).

WILKOX, A. (1993): Birth weight and perinatal mortality: The effect of maternal smoking. - Am. J. Epidem. *137*, 1098-1104.

WÓJTOWICZ, E. (1996a):The birth weight of newborns from different environments. - Przegl. Antrop. (in print; in Polish).

WÓJTOWICZ, E. (1996b): Estimation of state of health of the populations from selected areas. Academic Press, Lublin (in print; in Polish).

WÓJTOWICZ, E. (1996c): Developmental disturbances caused by ecological conditions. - Folia Morpholog. (in print)